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**EFFECTS OF INCREASING COW URINE DEPOSITION AREA ON SOIL  
MINERAL NITROGEN MOVEMENT AND PASTURE GROWTH ON A  
RECENT SOIL IN THE MANAWATU REGION, NEW ZEALAND**

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To my parents, Juan Carlos and Melania,  
who without expecting anything in return  
gave me the best of them.



## Abstract

The cow urine patch is a major source of nitrate ( $\text{NO}_3^-$ ) leaching from grazed dairy pasture farms. Increasing the urine deposition area is a direct way of reducing the potential risk of this cause N leaching losses. Research is required to quantify the effectiveness of this mitigation across a range of different soil and climatic conditions. The objective of this study was to determine the effect of increasing the cow urine deposition area on  $\text{NO}_3^-$  leaching risk and short-term pasture accumulation on Recent soil in the Manawatu Region, New Zealand. A field trial was conducted, which consisted of three treatments evaluated on pasture plots: Urine ( $1 \text{ m}^2$ ), Urine ( $0.2 \text{ m}^2$ ) and No-urine. The two urine treatments received the same volume of 2.1 L urine/patch. Urine treatments were applied on the 6<sup>th</sup> of March 2017, and soil inorganic N was measured on three occasions; 15, 36 and 53 days after urine application (DAUA). At the third soil sampling time, which was 24 days after the drainage season was estimated to have commenced, the net inorganic N (inorganic N in the urine treatment minus the value for the No-urine treatment) in the 45-120 cm soil depth was 1.08 g net inorganic N/patch for the Urine ( $1 \text{ m}^2$ ) treatment compared to 2.97 g net inorganic N/patch for the Urine ( $0.2 \text{ m}^2$ ) treatment. Therefore, the Urine ( $1 \text{ m}^2$ ) treatment resulted in a 63.6% reduction in the quantity of net inorganic N that was highly susceptible to leaching, compared to the more typical urine patch area of  $0.2 \text{ m}^2$ . At a paddock scale, when net inorganic N from the urine treatments is multiplied by an estimate of the quantity of urine patches per hectare in a single grazing, this equates to a reduction of 2.53 kg N/ha from a single autumn grazing. It is expected that increasing urine deposition area at multiple grazings would result in greater reductions in the annual  $\text{NO}_3^-$  leaching risk.

Over the two pasture harvests conducted in the trial, the pasture DM accumulation for the No-urine treatment produced an average of 3220 kg DM/ha. The two urine patch treatments achieved a similar level of pasture DM accumulation to that of the No-urine treatment. The lack of a pasture growth response from the added urine could have been influenced by the high clover content (35.9%) of the pasture, and in addition, there may have been adequate background soil mineral N levels, which together could have contributed to N not being growth limiting during the trial.

This research has demonstrated that increasing cow urine deposition area in autumn has potential to be an effective mitigation for decreasing N leaching losses from grazed dairy pastures. Further research is required to investigate the effects of increasing cow urine deposition area at multiple grazings, in order to determine the effect of this mitigation option on annual  $\text{NO}_3^-$  leaching and pasture production.

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